MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2015/2016

ETM7146 - SWITCHING AND NETWORKING TECHNIQUES AND SYSTEMS

(All section / Groups)

3 OCT 2015
9:00 A.M- 12:00 P.M.
(3 Hours)

INSTRUCTION TO STUDENT

1. This Question paper consists of 7 pages including cover page with 4 Questions only.

2. Attempt all **FOUR** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the answer Booklet provided.

Question 1

(a) Grading is a technique commonly used to reduce the number of switches needed for telecommunications switching systems. How does mixing from two diverse traffic groups improve the performance of grading systems?

[4 marks]

(b) As an engineer, you are asked to design a telephone system trunking for a new building that is currently being developed. The building is expected to hold 150 companies. Each company is expected to have an average of 70 outgoing calls and 50 incoming calls. Each call takes an average of 2 minutes. Find:

(i) The outgoing and incoming traffics for each company.

[3 marks]

(ii) The outgoing and incoming traffics for the whole building.

[3 marks]

(iii) Total occupancy of line for the whole building.

[2 marks]

(iv) The outgoing, incoming and total traffic lost if the outgoing calls have 3 calls lost and the incoming calls have 1 calls lost for each company.

[3 marks]

(v) The grade of service for each incoming and outgoing trunks.

[2 marks]

(c) Due to fast growing business activities on Penang Island, the existing switch at the local exchange has to be upgraded. Answer the following questions if the offered traffic is 13E.

(i) What is the minimum number of trunks lines does the switch need in order to comply with grade of service (GoS) of 0.001? (Refer to Erlang B traffic table in appendix)

[1 mark]

(ii) How much is the improvement on the GoS if one extra trunk is added?

[3 marks]

(iii) From (i), if one trunk is out of service, how much does the GoS deteriorate?

[3 marks]

(iv) Assume that the GoS in (iii) is still acceptable, what is the percentage of overload permissible with this new GoS?

[1 mark]

Continued...

Question 2

(a) By relating to the open system interconnection (OSI) protocol stack reference model, construct a similar protocol stack for the renowned Signaling System 7 (SS7) protocol in a time-division multiplexing (TDM) circuit-switching network.

[2 marks]

(b) If a single-stage switching network with 25 incoming and outgoing trunks respectively, find:

(i) What is the maximum number of simultaneous calls?

[1 mark]

(ii) What does it mean by full-availability. Discuss the term with respect to the given switching network.

[2 marks]

(iii) Calculate the percentage of crosspoints usage at high load. Comment on your result.

[3 marks]

(iv) Say that by using two-group gradings, the availability of the switching network is 15. Draw the full diagram and the grading diagram.

[Given: $k = s+c$, $N = 2s + c$
where k= availability, s = number of singles, c = number of commons]

[3 marks]

(c) With respect to common channel signaling (CCS) and inchannel signaling, answer the following questions:

(i) Why the control signal delay is high when an inband signaling technique is used?

[3 marks]

(ii) Compare between out of band inchannel signaling with CCS.

[4 marks]

(iii) Comment on when is best to implement associated mode and when to deploy disassociated mode.

[4 marks]

(iv) Discuss four disadvantages of CCS.

[3 marks]

Continued...

Question 3

(a) Design and draw a network for the following physical / medium access control (MAC) addressing scenario:

"There are 4 computer stations (node) with physical address 10, 28, 53 and 87, respectively. The 4 nodes are connected by a link which is of type bus topology local area network (LAN). The computer with physical address 10 is the sender, and the computer with physical address 87 is the receiver. During transmission, it is found that destination address does not match with a node with physical address 28, 53, thus the packet is dropped. Finally, a node with physical address 10 successfully sends a frame to a node with physical address 87.

[4 marks]

(b) A pure ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. Answer the following:

(i) Find the average frame transmission time.

[2 marks]

(ii) Find the vulnerable time.

[2 marks]

(iii) What is the requirement to make this frame collision-free?

[2 marks]

(iv) Draw a related diagram all of the above to support your answer.

[2 marks]

(c) A network using carrier sense multiple access/ collision detection (CSMA/CD) has a bandwidth of 10 Mbps. If the maximum propagation time (including the delays in the devices and ignoring the time needed to send a jamming signal) is 25.6 μs,

(i) find the minimum size of the frame.

[3 marks]

(ii) draw a related diagram all of the above to support your answer.

[2 marks]

(iii) what can the station do if there is a collision?

[2 marks]

(d) In an IPv4 packet, the value of header length (HLEN) is given with 5, and the value of the total length field is 40 bytes.

(i) How many bytes of data are being carried by this packet?

[3 marks]

(ii) If the value of HLEN is 1000 in binary. How many bytes of options are being carried by this packet?

[3 marks]

Continued...

Question 4

(a) Forwarding means to place the packet in its route to its destination. Forwarding requires a host or a router to have a routing table. Design and draw a simple network that consist of 2 hosts and 2 routers that follow both 'route method' and 'next-hop method' of forwarding. Shows related routing tables.

[7 marks]

(b) An IPv4 datagram has arrived with the following information in the header (in hexadecimal): 0x45 00 00 54 00 03 00 00 20 06 58 50 7C 4E 03 02 B4 0E 0F 02. Find the following:

(i) Version

[1 mark]

(ii) Header length

[1 mark]

(iii) Service

[1 mark]

(iv) Total Length

[1 mark]

(v) Identification

[1 mark]

(c) Figure 4(c) shows the flow of traversing a Multiprotocol Label Switching (MPLS) network. Each router has interfaces labeled 1, 2, 3. Complete the forwarding tables for routers R1, R2 and R3 that define the label distribution to destination 30.1. (Ignore processing delay and queuing delays)

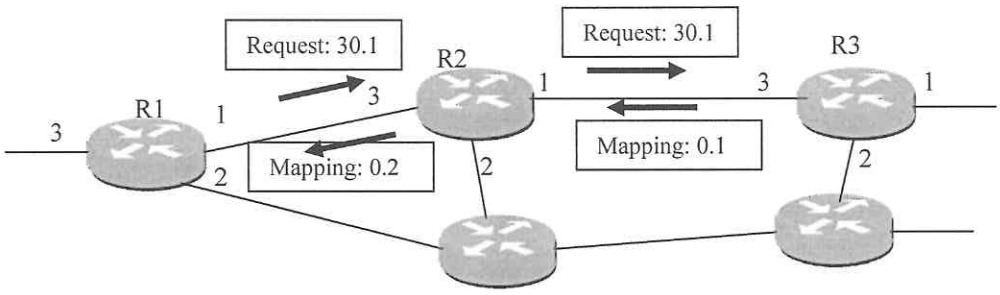

Figure 4(c)

[6 marks]

Continued...

(d) Figure Q4(d) shows a weighted graph with six nodes (labelled v1 to v6). By using the Dijkstra's shortest path algorithm, generate the least-cost path tree from node 6 to all other nodes.

[7 marks]

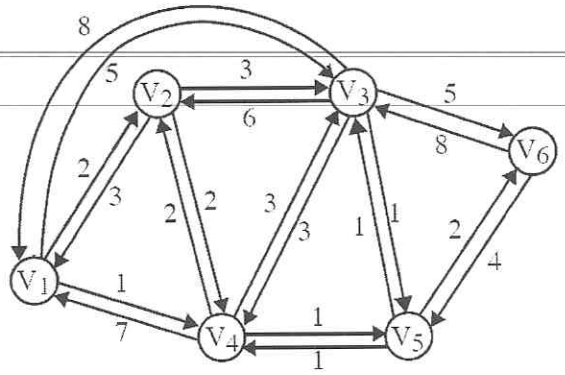

Figure 4(d)

End of Paper

Appendix

Number of trunks	1 lost call in 50 (0.02)	100 (0.01)	200 (0.005)	1000 (0.001)	Number of trunks	1 lost call in 50 (0.02)	100 (0.01)	200 (0.005)	1000 (0.001)
	E	*E*	*E*	*E*		*E*	*E*	*E*	*E*
1	0.020	0.010	0.005	0.001	51	41.2	38.8	36.8	33.4
2	0.22	0.15	0.105	0.046	52	42.1	39.7	37.6	34.2
3	0.60	0.45	0.35	0.19	53	43.1	40.6	38.5	35.0
4	1.1	0.9	0.7	0.44	54	44.0	41.5	39.4	35.8
5	1.7	1.4	1.1	0.8	55	45.0	42.4	40.3	36.7
6	2.3	1.9	1.6	1.1	56	45.9	43.3	41.2	37.5
7	2.9	2.5	2.2	1.6	57	46.9	44.2	42.1	38.3
8	3.6	3.2	2.7	2.1	58	47.8	45.1	43.0	39.1
9	4.3	3.8	3.3	2.6	59	48.7	46.0	43.9	40.0
10	5.1	4.5	4.0	3.1	60	49.7	46.9	44.7	40.8
11	5.8	5.2	4.6	3.6	61	50.6	47.9	45.6	41.6
12	6.6	5.9	5.3	4.2	62	51.6	48.8	46.5	42.5
13	7.4	6.6	6.0	4.8	63	52.5	49.7	47.4	43.4
14	8.2	7.4	6.6	5.4	64	53.4	50.6	48.3	44.1
15	9.0	8.1	7.4	6.1	65	54.4	51.5	49.2	45.0
16	9.8	8.9	8.1	6.7	66	55.3	52.4	50.1	45.8
17	10.7	9.6	8.8	7.4	67	56.3	53.3	51.0	46.6
18	11.5	10.4	9.6	8.0	68	57.2	54.2	51.9	47.5
19	12.3	11.2	10.3	8.7	69	58.2	55.1	52.8	48.3
20	13.2	12.0	11.1	9.4	70	59.1	56.0	53.7	49.2
21	14.0	12.8	11.9	10.1	71	60.1	57.0	54.6	50.1
22	14.9	13.7	12.6	10.8	72	61.0	58.0	55.5	50.9
23	15.7	14.5	13.4	11.5	73	62.0	58.9	56.4	51.8
24	16.6	15.3	14.2	12.2	74	62.9	59.8	57.3	52.6
25	17.5	16.1	15.0	13.0	75	63.9	60.7	58.2	53.5
26	18.4	16.9	15.8	13.7	76	64.8	61.7	59.1	54.3
27	19.3	17.7	16.6	14.4	77	65.8	62.6	60.0	55.2
28	20.2	18.6	17.4	15.2	78	66.7	63.6	60.9	56.1
29	21.1	19.5	18.2	15.9	79	67.7	64.5	61.8	56.9
30	22.0	20.4	19.0	16.7	80	68.6	65.4	62.7	58.7
31	22.9	21.2	19.8	17.4	81	69.6	66.3	63.6	58.7
32	23.8	22.1	20.6	18.2	82	70.5	67.2	64.5	59.5
33	24.7	23.0	21.4	18.9	83	71.5	68.1	65.4	60.4
34	25.6	23.8	22.3	19.7	84	72.4	69.1	66.3	61.3
35	26.5	24.6	23.1	20.5	85	73.4	70.1	67.2	62.1
36	27.4	25.5	23.9	21.3	86	74.4	71.0	68.1	63.0
37	28.3	26.4	24.8	22.1	87	75.4	71.9	69.0	63.9
38	29.3	27.3	25.6	22.9	88	76.3	72.8	69.9	64.8
39	30.1	28.2	26.5	23.7	89	77.2	73.7	70.8	65.6
40	31.0	29.0	27.3	24.5	90	78.2	74.7	71.8	66.6
41	32.0	29.9	28.2	25.3	91	79.2	75.6	72.7	67.4
42	32.9	30.8	29.0	26.1	92	80.1	76.6	73.6	68.3
43	33.8	31.7	29.9	26.9	93	81.0	77.5	74.3	69.1
44	34.7	32.6	30.8	27.7	94	81.9	78.4	75.4	70.0
45	35.6	33.4	31.6	28.5	95	82.9	79.3	76.3	70.9
46	36.6	34.3	32.5	29.3	96	83.8	80.3	77.2	71.8
47	37.5	35.2	33.3	30.1	97	84.8	81.2	78.2	72.6
48	38.4	36.1	34.2	30.9	98	85.7	82.2	79.1	73.5
49	39.4	37.0	35.1	31.7	99	86.7	83.2	80.0	74.4
50	40.3	37.9	35.9	32.5	100	87.6	84.0	80.9	75.3